5E Lesson Plan

Teacher: Garski

Date / Timing: Two – three 50 minute lesson periods

Subject / grade level: Physics (grade 10 – 11)

Materials:
STEMonstration video via NASA website or YouTube:
https://youtu.be/OpxGp2P48kI

Roller Coaster Planning Sheet

Marbles

Tubing material (pipe insulation or flexible water piping works best)

Masking tape

Measuring devices (tape measures or meter sticks)

Stop watches

Performance Objective
SWBAT: Explain kinetic and potential energy and how these concepts apply to earth and space.

CCSS Lesson objective(s):
HS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. **Science and Engineering Practices**: Using Mathematics and Computational Thinking. **Disciplinary Core Ideas**: PS3.A: Definitions of Energy; PS3.B: Conservation of Energy and Energy Transfer. **Crosscutting Concepts**: Systems and System Models.

MS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **Science and Engineering Practices**: Analyzing and Interpreting Data. **Disciplinary Core Ideas**: PS3.A: Definitions of Energy. **Crosscutting Concepts**: Scale, Proportion, and Quantity

MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. **Science and Engineering Practices**: Developing and Using Models. **Disciplinary Core Ideas**: PS3.A: Definitions of Energy; PS3.C: Relationship between Energy and Forces. **Crosscutting Concepts**: Systems and System

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ENGAGEMENT

Teacher will engage students by first asking
"Who has ever ridden a roller coaster?"
"Would a roller coaster work in space?"
"How do you think roller coasters work>"

Students engage by watching a short video demonstrating the relationship between potential and kinetic energy.

Video: NASA STEMonstrations: Kinetic and Potential Energy
https://youtu.be/OpxGp2P48kI

EXPLORATION

- Students are grouped by ability in groups ranging from 3 - 4

Day 1:

- Teacher reviews the engineering design process, specifically in defining the problem and the project requirements including that the roller coaster must have at least three hills including the initial hill and that a limited supply of tubing will be provided.
- Students are guided to brainstorm a roller coaster plan using a planning sheet
- Once brainstorming plan is approved, students will be provided with tubing material, tape and a marble to begin construction.
- If time allows, students test their design to see if the marble makes it to the end of the track.
- Adjustments and improvements can be made.

Day 2:

- Students continue to make necessary adjustments and improvements to ensure the marble completes the track.
- Students then complete the questions on the planning sheet.

EXPLANATION

Day 2, con't:

- Teacher pulls students back into a large group to discuss the concepts of potential and kinetic energy. A more formal lesson of these concepts including relevant equations is presented.

ELABORATION

Day 3:

- Students use the formal definition of and equations for kinetic and potential energy to calculate kinetic and potential energy at specific points in this roller coaster.
- Students graph potential and kinetic energy for their roller coaster as a final assessment of understanding.

EVALUATION

- Teacher will informally evaluate student understanding through circulation and questioning
- Formal summative assessment will be completed at the end of the unit.